

## New Records and New Species of *Vetulonia* Dall, 1913 and *Brookula* Iredale, 1912 from Brazil (Gastropoda: Trochidae)

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**Abstract.** The genus *Vetulonia* Dall, 1913 is reported for the first time from South America, on the basis of specimens of *Vetulonia jeffreysi* Dall, 1917 and *Vetulonia parajeffreysi* sp. nov. collected off Rio de Janeiro State in southern Brazil. *Vetulonia parajeffreysi* sp. nov. resembles *V. jeffreysi*, from which it differs in its small protoconch which is not projected beyond the first teleoconch whorl. *Vetulonia parajeffreysi* differs from *Vetulonia densilirata* Dall, 1927 in the aperture shape and the number of axial ribs. Three new species of *Brookula* from Brazil are described: *Brookula megaumbilicata* sp. nov., which differs from all other South American species of *Brookula* in its wide and deep umbilicus and shouldered axial ribs close to the sutures; *Brookula proseila* sp. nov., which differs from *Brookula conica* (Watson, 1886) by the presence of spiral cords entering the umbilicus; and *Brookula olearia*, with a somewhat angulate last whorl, spiral revolving cords regularly spaced not crossing axial ribs, thicker and closely packed in the base and with thick spiral cords surrounding umbilicus. A key for identification of the Brazilian species of *Brookula* is presented.

### INTRODUCTION

The Brazilian species of the genus *Brookula* Iredale, 1912 were recently reviewed by Absalão et al. (2001), who recognized three species: *Brookula conica* (Watson, 1886), *Brookula pfefferi* Powell, 1951 and *Brookula spinulata* Absalão, Myiaji & Pimenta, 2001. Some time after publishing that paper, we gained access to some specimens collected in northeast and southeast coasts off Brazil, which included three additional, undescribed species of *Brookula*, as well as two species of the genus *Vetulonia* Dall, 1913.

This report is based entirely on empty shells collected during oceanographic expeditions conducted in 2001 and 2002 by the Brazilian Government (Programa REVIZEE) and Petrobras—Brazilian Petroleum Company (Campos Basin Deepsea Environmental Programme) off the south-east and northeast coast of Brazil.

In the lists of material examined, the numbers in brackets refer to the number of shells in each lot. Counting of protoconch whorls followed the method used by Leal (1991).

Abbreviations used through the text: ANSP—Academy of Natural Sciences of Philadelphia, Philadelphia; BMNH—The Natural History Museum, London; CEN-PES—Centro de Pesquisas da Petrobras; DOUFPE—Departamento de Oceanografia, Universidade Federal de Pernambuco, Recife; IBUFRJ—Instituto de Biologia, Universidade Federal do Rio de Janeiro, Rio de Janeiro;

MCZ—Museum of Comparative Zoology, Harvard; MLP—Museu de LaPlata, LaPlata; MNHN—Muséum National d'Histoire Naturelle, Paris; MNRJ—Museu Nacional/Universidade Federal do Rio de Janeiro, Rio de Janeiro; MORG—Museu Oceanográfico “Eliézer de Carvalho Rios” da Fundação Oceanográfica do Rio Grande, Rio Grande; MZSP—Museu de Zoologia, Universidade de São Paulo, São Paulo; Programa REVIZEE—Recursos Vivos da Zona Econômica Exclusiva, Astro Garoupa coll.; UERJ—Universidade do Estado do Rio de Janeiro; USNM—United States National Museum of Natural History, Washington, DC; sta—collecting stations numbers.

### SYSTEMATICS

Superfamily TROCHOIDEA Rafinesque, 1815

Family TROCHIDAE Rafinesque, 1815

Subfamily Calliotropiinae Hickman & McLean, 1990

Genus *Vetulonia* Dall, 1913

*Vetulonia* Dall, 1913: 86. Type species by original designation: *Vetulonia galapagana* Dall, 1913: 87 (holotype photograph in Warén & Bouchet, 1993: fig. 7c).

**Diagnosis:** Shell small, turbinata, thin, umbilicate. Protoconch globose with irregular wart-like concretions. Axial ribs strictly opisthocline, crossed by less developed

spiral threads. Suture deep. Aperture subquadrangular; peristome interrupted by the body whorl.

*Vetulonia jeffreysi* Dall, 1917

Figures 1, 2

*Trochus cancellatus* Jeffreys, 1883: 96, pl. 20, fig. 4.  
*Vetulonia jeffreysi* Dall, 1913: 87 (*nomen novum* pro *Trochus cancellatus* Jeffreys, 1883 non Munster, 1842).  
*Vetulonia josephinae* Dall, 1927: 120 (*nomen novum* pro *Trochus cancellatus* Jeffreys, 1883 non Roemer, 1835).

**Type material:** Presumably in BMNH; not examined.

**Type locality:** Josephine Bank, 600–800 m. Around 36°N, 14°W (off Portugal, Northeast Atlantic).

**Material examined:** IBUFRJ 12737, [1] Bahia State, REVIZEE sta 4 (14°48'30"S, 38°55'W, 250 m), 02/vii/2001.

*Vetulonia parajeffreysi* sp. nov.

Figures 3–8

**Type material:** Holotype: MNRJ 9845, Bacia de Campos (22°38'46.64"W, 40°60'13.05"S, 1290 m); paratypes: MNRJ 8912—REVIZEE sta 50 (20°50'S, 39°14'W, 1600 m), 20/vii/2001; MORG 41061; IBUFRJ 12739—Bacia de Campos sta 2 (21°57'S, 39°50'03"W, 1200 m); MNHN—type locality; ANSP 410937—Bacia de Campos (22°37'27.42"S, 40°40'57.95"W, 1285 m).

**Type locality:** Bacia de Campos (22°38'46.64"W, 40°60'13.05"S, 1290 m), Rio de Janeiro State, southeast of Brazil.

**Additional material:** IBUFRJ 12738, [1] Bacia de Campos sta 43 (22°43'11.1"S, 40°12'17.1"W, 1157 m); IBUFRJ 12734, [1] Bacia de Campos (22°38'46.64"S, 40°60'13.05"W, 1290 m); IBUFRJ 12736, [1] REVIZEE sta 50 (20°50'S, 39°14'W, 1600 m), 20/vii/2001.

**Diagnosis:** Shell small, low-trochiform; protoconch small, not projecting beyond first teleoconch whorl; teleoconch whorls convex with narrow, strongly prosocline ribs, expanding into the narrow and deep umbilicus; fine, raised spiral lines forming small nodules where they cross the axials.

**Description:** Shell low-trochiform, reaching 2.8 mm in height, 3.0 mm in width; spire somewhat elevated, umbilicated, color white. Protoconch small (diameter about 260  $\mu$ m), not projecting beyond shell profile. Teleoconch with up to three convex whorls. Axial sculpture consisting of narrow, prosocline ribs (about 18 on last whorl) that continue through base of shell, entering umbilicus. Spiral sculpture consisting of about 12 fine, regularly spaced ribs on last whorl, through interspaces and over axial ribs forming small nodules where they cross the axials, especially on the base. Aperture rounded, peri-

stome interrupted by last whorl. Umbilicus narrow and deep. Outer lip thin.

**Etymology:** The species is named after its similarity to *Vetulonia jeffreysi* Dall, 1917.

Subfamily Eucyclinae Koken, 1897

Genus *Brookula* Iredale, 1912

*Brookula* Iredale, 1912: 219. Type species by original designation: *Brookula stibarochila* Iredale, 1912: 220 (holotype photograph in Clarke 1961: pl. 1, fig. 5).

**Diagnosis:** Shell small, globose-turbinate, thin, umbilicate, with inflated whorls. Protoconch smooth or sculptured with anastomosing ribs forming microscopic pits or with irregular wart-like concretions. Axial sculpture dominant; raised spiral sculpture well-defined, but weaker, in some species overriding and forming beads at intersections with axial ribs; fine incremental growth lines are present. Suture deeply constricted. Aperture rounded, slightly oblique, with a slightly thickened lip and complete peritreme.

*Brookula megaumbilicata* sp. nov.

Figures 11–16

**Type material:** Holotype: MNRJ 9626; paratypes: MZSP 36359 (two shells); IBUFRJ 13562 (one shell); ANSP 410938 (one shell); MNHN (one shell); MORG 41062 (one shell)—type locality; MNRJ 9627 (two shells); MNRJ 9844 (seven shells); IBUFRJ 12744 (eight shells); IBUFRJ 12735 (two shells)—Bacia de Campos sta 41 (22°39'28.1"S, 40°08'27"W, 1222 m).

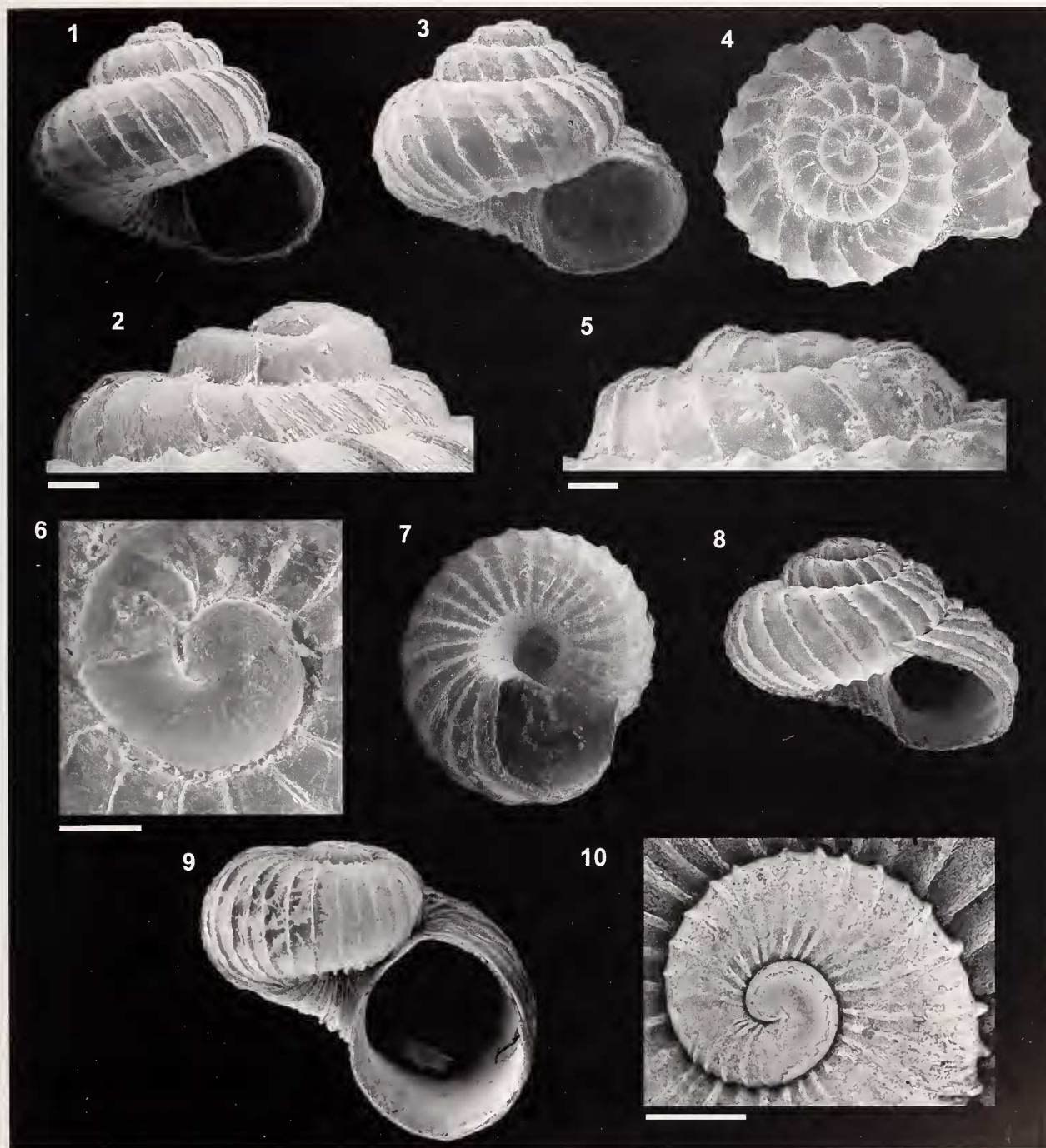
**Type locality:** Bacia de Campos sta 2 (21°57'S, 39°50'03"W, 1200 m); Rio de Janeiro State, southeast of Brazil.

**Additional material:** IBUFRJ 12743, [3] Bacia de Campos sta 2 (21°57'S, 39°50'03"W, 1200 m); IBUFRJ 12745, [2] Bacia de Campos sta 42 (22°41'33.2"S, 40°10'29.6"W, 1195 m).

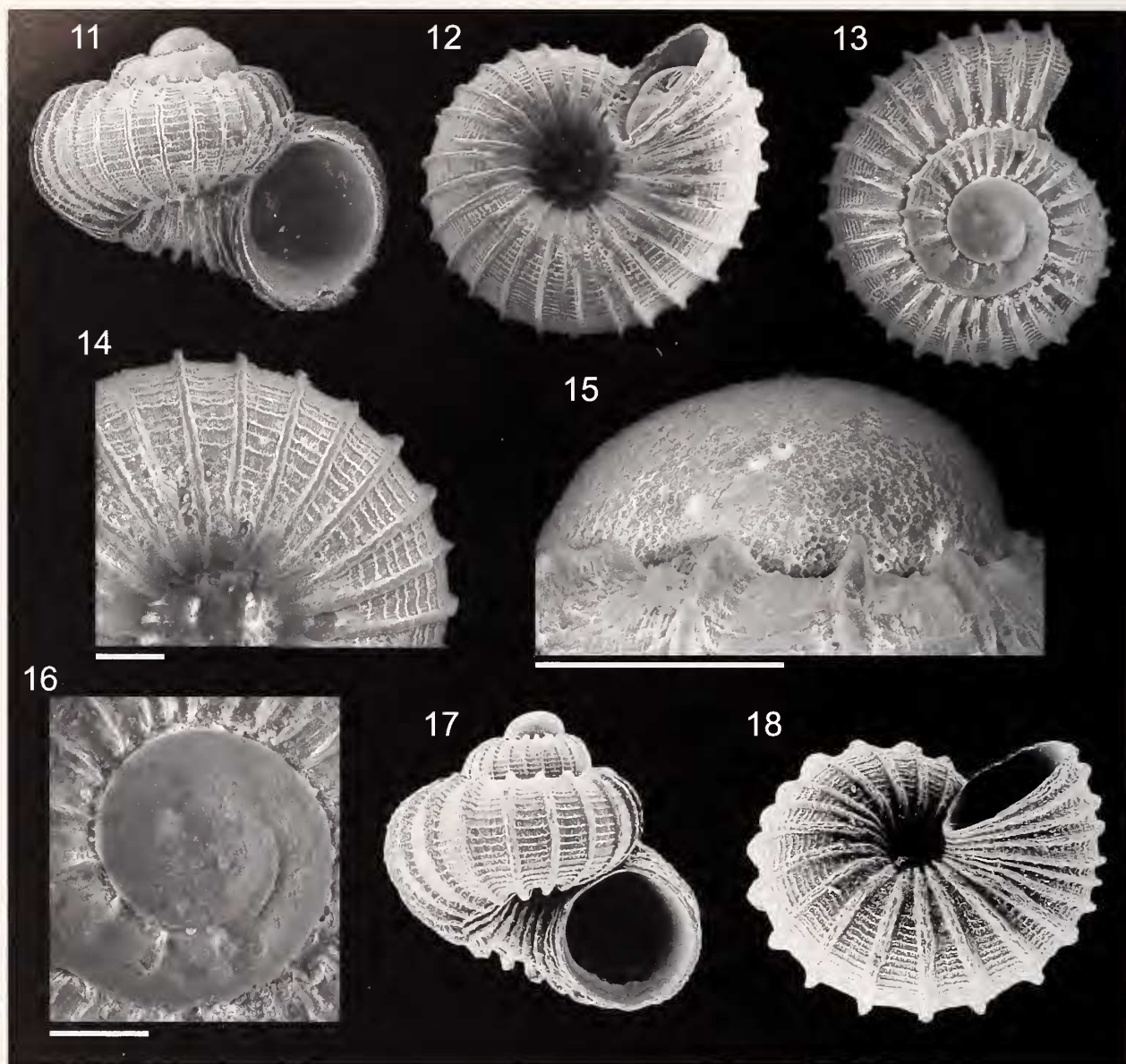
**Diagnosis:** Shell small, low-trochiform; axial ribs somewhat angulate below suture and on base; thin spiral revolving cords, regularly spaced, not crossing axial ribs and absent in band below suture and surrounding the very deep and wide umbilicus.

**Description:** Shell small, low-trochiform, broadly umbilicate, color white; reaching 1.54 mm in height, 1.52 mm in width. Protoconch globose with about 1¼ whorls, around 190  $\mu$ m in diameter sculptured with fine, densely crowded anastomosing ribs forming microscopic pits in a somewhat alveolar pattern. Teleoconch with up to 1½ whorls, with convex profiles. Suture deep. Axial sculpture consisting of narrow, orthocline ribs (27 on last whorl in holotype) that continue through base of shell, entering





Figures 1–10. Genus *Vetulonia*: Figs. 1, 2: *Vetulonia jeffreysi* Dall, 1917. 1: IBUFRJ 12737, apertural view (width 3.75 mm); 2: protoconch in frontal view. Figures 3–8: *Vetuloonia parajeffreysi* sp. nov.: 3: apertural view (width 3.13 mm) (holotype); 4: apical view (width 3.00 mm) (paratype IBUFRJ); 5: protoconch in frontal view (holotype); 6: protoconch in apical view (paratype IBUFRJ); 7: basal view (width 3.20 mm) (paratype MNHN); 8: apertural view (USNM 94312) (3.00 mm width). Figures 9–10: *Vetuloonia densilirata* (holotype, USNM 108116). 9: apertural view (width 3.00 mm); 10: protoconch in apical view. Scale bars: 100  $\mu$ m.



Figures 11–16. *Brookula megaumbilicata* sp. nov.: 11. holotype, MNRJ 9626 (width 1.00 mm), apertural view; 12. paratype, MNRJ 9844 (width 1.00 mm), basal view; 13. paratype, MORG 41062 (width 0.75 mm), apical view; 14. paratype (IBUFRJ 13562), detail of sculpture and umbilicus; 15. paratype (IBUFRJ 13562), protoconch in frontal view; 16. paratype (MORG 41062), protoconch in apical view. Scale bars: 100 µm.

Figures 17–18. *Brookula conica* (Watson, 1886): 17. MZSP 32945 (width 0.71 mm), frontal view; 18. MZSP 32495, basal view (width 0.74 mm).

wide umbilicus; axial ribs somewhat angulate below suture, giving rise to a lamellar shoulder, and on base of last whorl; microscopic axial lines present through interspaces. Spiral sculpture of 22 (last whorl + base) prominent, thin, regularly spaced, revolving cords that do not cross the axial ribs; absent in plain band below suture and surrounding umbilicus. Aperture rounded holostomate. Umbilicus wide and deep, bases of all teleoconch whorls visible. Outer lip thin.

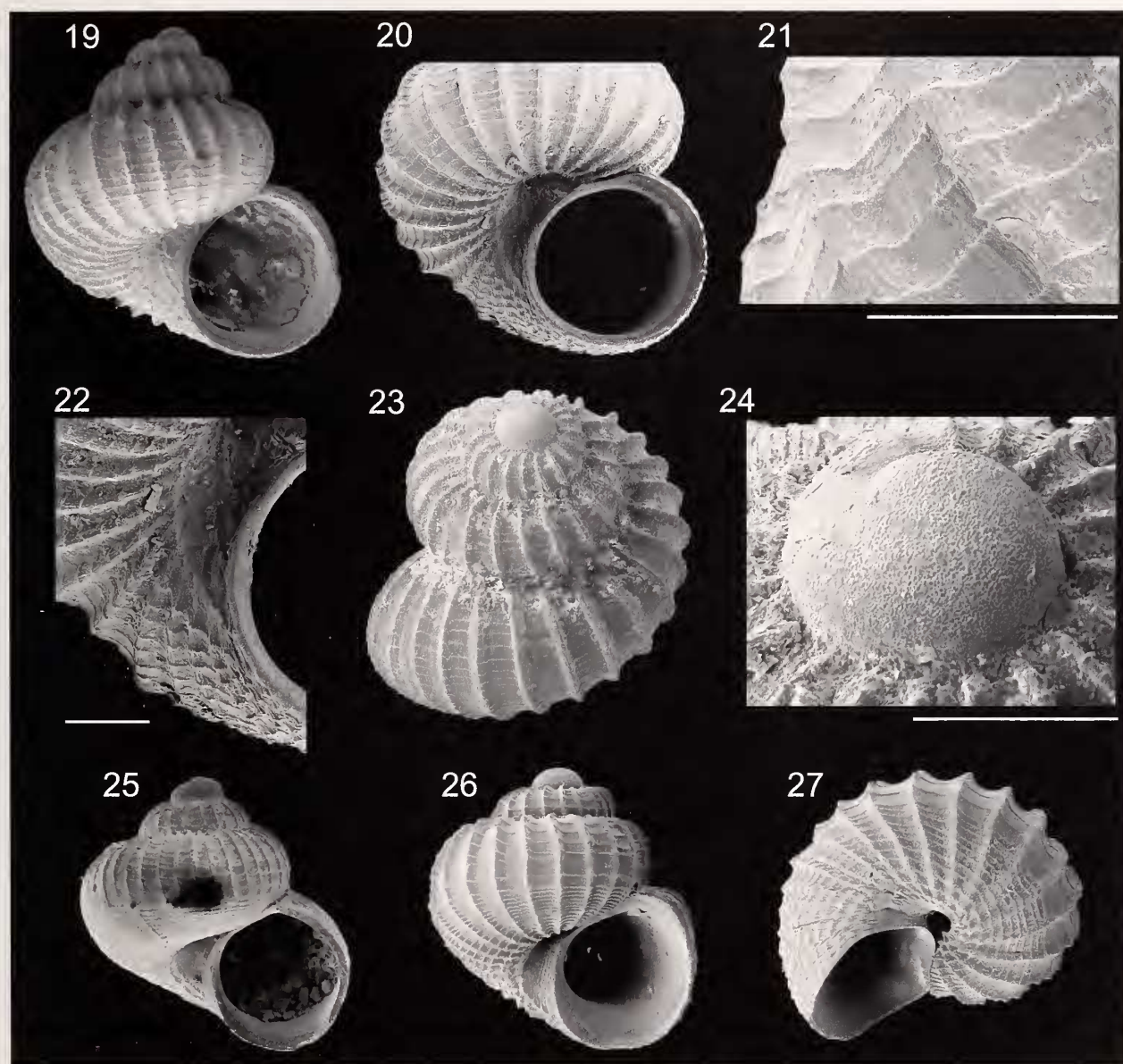
**Etymology:** This species' name derives from: *mega* (Latin) = large + *umbilicata* (Latin) = with an umbilicus; referring to the wide umbilicus of the species.

*Brookula proseila* sp. nov.

Figures 19–24

**Type material:** Holotype: MNRJ 9956; paratypes (one shell in each lot): IBUFRJ 12746; MNHN; ANSP





Figures 19–24. *Brookula proseila* sp. nov.: 19–22. holotype, MNRJ 9956 (width 1.74 mm). 19. apertural view; 20. basal view; 21. detail of sculpture on last whorl; 22. detail of sculpture on umbilicus region; 23, 24. paratype IBUFRJ 12746. 23. apical view (width 1.57 mm); 24. protoconch in apical view.

Figure 25. *Brookula pfefferi* Powell, 1951: MZSP 32506 (width 1.25 mm).

Figures 26, 27. *Brookula spinulata* Absalão, Miyaji & Pimenta, 2001: IBUFRJ 13827. 26. apertural view (width 1.20 mm), 27. basal view. Scale bars: 200 µm.

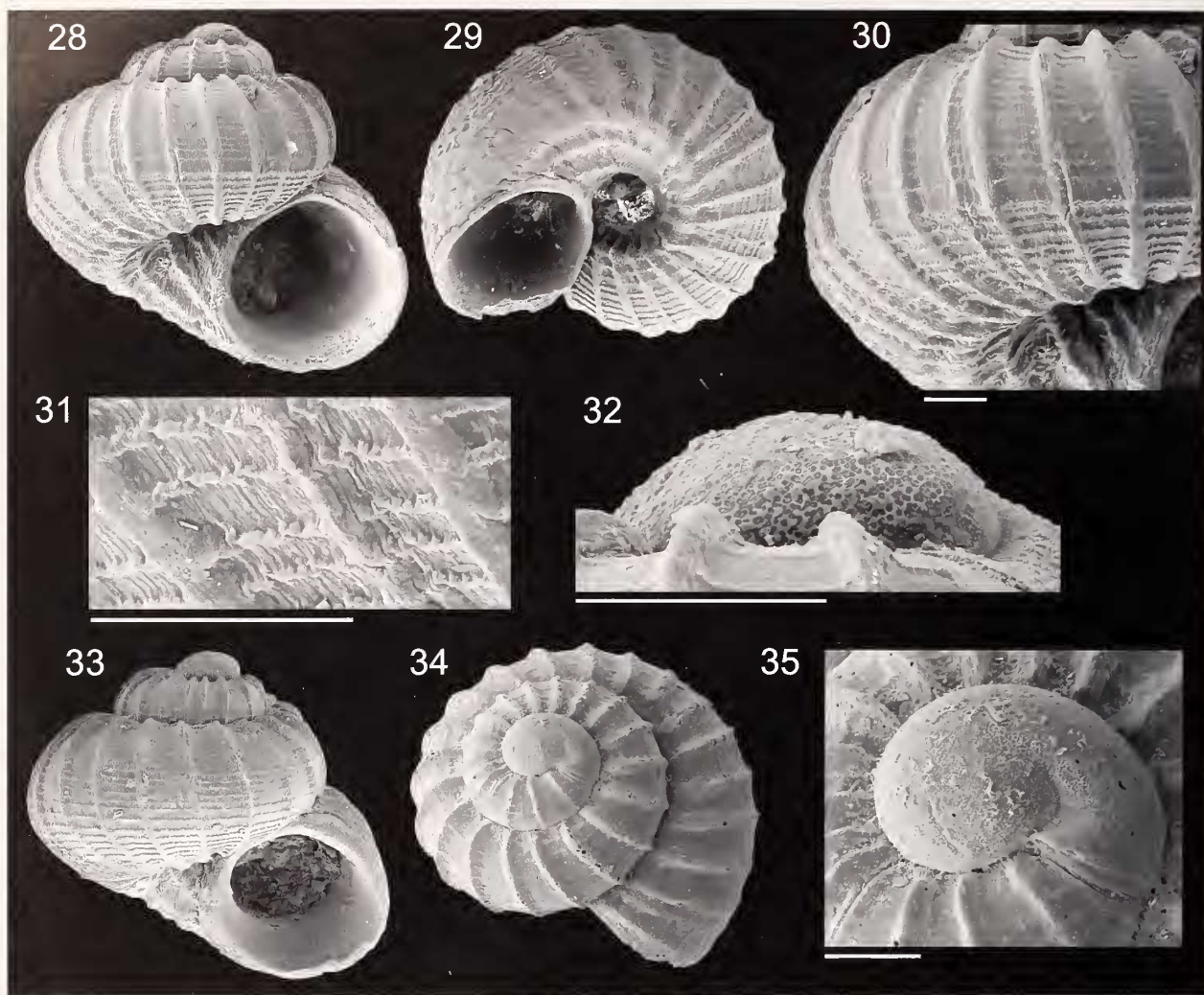
411189; MZSP 37822; MORG 41065; DOUFPE 4448. All types from type locality, except DOUFPE 4448—off Sergipe State sta 9.2 (11°30'08"S, 37°07'56"W, 900 m).

**Type locality:** REVIZEE sta 5 (15°34.08'S, 38°49.81'W, 50 m), Bahia State, northeast of Brazil.

**Additional material:** DOUFPE 4449, off Sergipe State sta 5.3 (11°24'44"S, 37°03'35"W, 500 m), 17/iv/2002;

DOUFPE 4450, off Pernambuco State; IBUFRJ 13268, REVIZEE sta 5 (15°34.08'S, 38°49.81'W, 50 m), Bahia State, northeast of Brazil.

**Diagnosis:** Shell small, low-trochiform; axial ribs somewhat angulate below suture and on base; thin spiral revolving cords, regularly spaced, not crossing axial ribs and absent in band below suture and surrounding the very deep and wide umbilicus.



Figures 28–35. *Brookula olearia* sp. nov.: 28–32. holotype, MNRJ 9958 (width 1.00 mm). 28. apertural view; 29. basal view; 30. detail of last whorl and base; 31. detail of sculpture on base area of last whorl; 32. protoconchs in frontal view; 33. paratype MNRJ 9957 (width 1.16 mm) apertural view; 34, 35. paratype IBUFRJ 13863 (width 1.08 mm). 34. apical view; 35. protoconch in apical view. Scale bars: 100  $\mu$ m.

**Description:** Shell medium sized, trochiform, spire elevated, umbilicated, color white; reaching 1.91 mm in height, 1.67 mm in width. Protoconch globose with about  $1\frac{1}{4}$  whorls, around 260  $\mu$ m in diameter, sculptured with fine, densely crowded anastomosing ribs forming microscopic pits in a somewhat alveolar pattern. Teleoconch with up to three whorls, with convex profiles, somewhat flattened posteriorly, just below the deep suture. Axial sculpture consisting of heavy, narrow, orthocline ribs (24 on last whorl in holotype) that continue through base of shell, entering the umbilicus; interspaces wide, about three times rib width; very fine microscopic axial lines present through interspaces. Spiral sculpture of about 20 (last whorl + base) prominent, thin, regularly spaced, revolving cords that cross the axial ribs and three-four wid-

er spiral cords entering the umbilicus. Aperture rounded holostomate. Umbilicus circular, narrow and deep. Outer lip thin.

**Etymology:** This species' name derives from: *proseilos* (Greek) = toward the sun, sunny, warm; an allusion to the type locality which is in shallow warm waters, in opposition to most of other western Atlantic *Brookula* species, which are from deep and/or cold waters.

*Brookula olearia* sp. nov.

Figures 28–35

**Type material:** Holotype: MNRJ 9958; paratypes: IBUFRJ 13862 (eight shells), MNHN (one shell), ANSP



411190 (one shell), MZSP 37821 (one shell)—type locality; MNRJ 9957; (one shell)—Bacia de Campos sta 60 (21°52'50.445"S, 39°51'42.6"W, 1050 m); IBUFRJ 13863 (one shell), MORG 41066 (one shell)—Bacia de Campos sta 45 (22°10'54.322"S, 39°52'19.432"W, 1050 m).

**Type locality:** Bacia de Campos sta 61 (21°52'51.9"S, 39°48'11.680"W, 1350 m), Rio de Janeiro State, southeast of Brazil.

**Diagnosis:** Shell small, low-trochiform, last whorl somewhat alculate; axial ribs somewhat angulate below suture; thin spiral revolving cords, regularly spaced, not crossing axial ribs, thicker and closely packed in the base; umbilicus somewhat wide, with thick surrounding spiral cords.

**Description:** Shell very small, low-trochiform, somewhat angulated on last whorl, umbilicated, color white; holotype with 1.00 mm in width. Protoconch globose with about 1.25 whorls, around 200  $\mu$ m in diameter, sculptured with fine, densely crowded anastomosing ribs forming microscopic pits in a somewhat alveolar pattern. Teleoconch with up to 2.5 whorls, with convex profiles, last whorl somewhat angulated. Axial sculpture consisting of heavy, narrow, somewhat opisthocline ribs and agulate below suture (23 on last whorl in holotype) that continue through base of shell, entering the umbilicus, where they become feeble; interspaces wide, about three times rib width; very fine microscopic axial lines present through interspaces. Spiral sculpture of about 25 (last whorl + base) prominent, thin, regularly spaced, revolving cords that do cross the axial ribs; the spiral cords on the base are thicker and closely packed than in the rest of the shell. Aperture rounded holostomate. Umbilicus circular, somewhat wide and deep, surrounded by four cords, two of them entering the umbilicus. Outer lip thin.

**Etymology:** This species' name derives from: *olearius* (Latin) = of oil; referring to the petroleum rich region where the species were collected.

## DISCUSSION

Clarke (1961) and Vaught (1989) placed *Vetulonia* as a subgenus of *Brookula*, in the Cyclostrematidae. However, Warén & Bouchet (1993), basing their decision on the radula, shell and external anatomy of *Vetulonia jeffreysi* Dall, 1917, considered *Vetulonia* as a distinct genus, belonging to the subfamily Calliotropiinae in the Trochidae.

Although nothing is known about the radula or the anatomy of the soft parts of the only Brazilian specimen referred herein to *V. jeffreysi*, its general shell shape, sculpture pattern and protoconch shape (Figures 1, 2) are very similar to the original illustration and description of the species, as well as to the illustration and description provided by Warén & Bouchet (1993: 12, figures 7d–f). The large, well projected, and bulbous protoconch (Figure 2) are diagnostic features distinguishing *V. jeffreysi*. In

comparison with *V. jeffreysi*, *V. parajeffreysi* has a smaller protoconch, almost not projected from the first teleoconch whorl (Figure 5). Another species from the Western Atlantic, *Vetulonia densilirata* Dall, 1927 (Figures 9, 10), has about 30 orthocline axial ribs, less marked spiral sculpture and an ovoid aperture, whereas *V. parajeffreysi* has fewer (about 17) and prosocline axial ribs (Figures 3, 4, 8), stronger spiral cords and a subquadrate aperture (Figure 2).

Both *Vetulonia jeffreysi* Dall, 1913 and *Vetulonia jozeplinae* Dall, 1927 were proposed as new names for *Trochus cancellatus* Jeffreys, 1883 non Munster, 1842; non Roemer, 1835. Since the type of both names is that of the original taxon of Jeffreys, the two Dall names are objective synonyms. Although the species occurs mainly in the eastern Atlantic, Dall (1913) reported a specimen from the Yucatan Channel, Mexico (western Atlantic). In the collection of the U.S. National Museum of Natural History there is a shell (USNM 94312) (Figure 8) labeled as *Trochus cancellatus* from off Yucatan, which has a second label on which is written "*Vetulonia jeffreysi* Dall, off Yucatan." On this second label, the word "type" is also indicated. However it is certainly not the type of *V. jeffreysi*, because the type locality of this species is Europe. The relatively high spire and depressed protoconch of this specimen suggest that it is a shell of *Vetulonia parajeffreysi*.

*Cyclostrema crassicostatum* Strebel, 1908, a species described from 54°43'S, 064°08'W on the basis of a single shell, and sometimes regarded as a *Brookula* (Castellanos & Landoni, 1989; Absalão et al., 2001), is very similar to young specimens of *V. parajeffreysi* in general shell shape, prosocline axial ribs and in lacking any spiral sculpture. However, *C. crassicostatum* can be distinguished from *V. parajeffreysi* by its narrower umbilicus and wider and lower shell.

The systematic position of the genus *Brookula* is controversial. Hickman & McLean (1990) included *Brookula* in the Skeneidae, but Vaught (1989) and Rios (1994) assigned it to the Cyclostrematidae. Warén (1992: 198) considered the genus to belong to the Trochidae, because of the similarity of the type-species to other species of the Eucyclinae (sensu Hickman & McLean, 1990). However, Warén & Bouchet (1993) considered the position of the Eucyclinae, for which only fossil species were recognized, as uncertain. Hickman (1998) listed extant genera in this subfamily and included it in the Trochidae, but excluded *Brookula*. In the present report we have included the genus *Brookula* in the Eucyclinae, Trochidae following Warén (1992) and Absalão et al. (2001). This allocation should be considered a provisional one until more data become available.

The most similar southwestern Atlantic species to *Brookula megaumbilicata* (Figures 11–16) is *Brookula conica* (Watson, 1886), which resembles the former species in size, general shell shape, protoconch morphology

and sculpture pattern. They can be distinguished by the umbilicus, which is large and deep in *B. megaumbilicata* (Figures 12, 14) and narrower in *B. conica* (Figure 18). Moreover, the axial ribs in *B. megaumbilicata* are more numerous and are unequal in height along their length, being taller in their apical part, giving rise to a small shoulder below the sutures, and in their basal part (Figure 11); in *B. conica* the axial ribs are the same height along their entire length (Figure 17). The spiral lines in *B. megaumbilicata* are restricted to the interspaces between the axial ribs, i.e., do not cross them (Figure 14), and are absent in a band just below the sutures (Figure 13); while in *B. conica* the spiral lines are present through the whole extent of the interspaces and cross the axial ribs (Figures 17–18). Secondly, the species can be distinguished by the shorter spire of *B. megaumbilicata*.

*Brookula proseila* is similar in its general sculpture to *Brookula pfefferi* Powell, 1951 (Figure 25) and *Brookula spinulata* Absalão, Miyaji & Pimenta, 2001 (Figures 26, 27), differing from both species in the uniformly spaced spiral lines in the interspaces, including the base. In *B. pfefferi* and *B. spinulata*, the spiral lines are farther apart on the last whorl and more closely packed on the base. *Brookula proseila* is proportionally higher (ratio height  $\times$  width =  $1.09 \pm 0.05$ ,  $n = 6$ ) than *Brookula pfefferi* (ratio height  $\times$  width =  $1.01 \pm 0.04$ ,  $n = 13$ , fide Absalão et al. (2001)).

The holotype of *Brookula lamonti* Powell, 1951 is a shell fragment with umbilicus, aperture and part of the sculpture of the last whorl still visible. Unfortunately it is not enough to give a secure identification to *Brookula lamonti*. So, *Brookula lamonti* is considered as unrecognizable.

*Brookula proseila* is very similar, in shell shape to the original figure of *Brookula conica*, but *B. conica* have a distinct umbilicus, without spiral cords and strong axial ribs that enter it; in *B. proseila*, on the other hand, the axial ribs do not enter the umbilicus and there are two surrounding cords entering the umbilicus (Figures 20, 22).

*Brookula olearia* (Figures 28–35) is similar in size and general shell shape to *B. megaumbilicata* and *B. conica*, but its profile is somewhat angulated while *B. megaumbilicata* (Figure 11) and *B. conica* (Figure 17) are more regularly convex. The spiral cords on the base of *B. olearia* (Figures 28, 30) are thicker and more closely packed than in the rest of the whorls; in *B. megaumbilicata* (Figure 11) and *B. conica* (Figure 17), the spiral cords are uniformly spaced and of same thickness over all surface of the shell. The axial ribs in *B. olearia* are somewhat taller in their apical part only (Figures 28, 30, 33), while in *B. megaumbilicata* the axial ribs are taller in both apical and basal parts (Figure 11). The umbilicus of *B. olearia* (Figure 29) is somewhat intermediary between the narrower umbilicus of *B. conica* (Figure 18) and the wider one of *B. megaumbilicata* (Figure 12), but

only *B. olearia* has distinct spiral cords surrounding and entering it (Figures 28–30). Because of the spiral cords more packed on the base, *B. olearia* could be confounded with young specimens of *B. pfefferi* and *B. spinulata*; however, the spiral cords on the base of *B. pfefferi* (Figure 25) and *B. spinulata* (Figures 26, 27) are as thick as in the rest of the shell, while in *B. olearia*, the cords are thicker in the base (Figure 28, 30); besides that, the spiral cords always cross the axial ribs in the base in *B. pfefferi* (Figure 25) and in *B. spinulata* (Figures 26, 27), while in *B. olearia* they do not cross the ribs (Figure 31). Additionally, the umbilicus of *B. olearia* is wider and the cords surrounding it are thicker (Figures 28–30) than in those above-mentioned species.

Absalão et al. (2001) described a kind of protoconch sculpture that is present in the three *Brookula* species from Brazil which they studied (*B. conica*, *B. spinulata* and *B. pfefferi*), consisting of very densely crowded anastomosing ribs, forming microscopic pits in a somewhat alveolar pattern. This kind of sculpture is also present in *B. proseila*, *B. megaumbilicata* and *B. olearia*.

#### Key for the Identification of the Species of *Brookula* from Brazil

- 1 Spiral lines equally spaced on last whorl, from suture to umbilical region ..... 2
- Spiral lines more closely packed on the base ..... 4
- 2 Spiral cords surrounding the umbilicus ..... *Brookula proseila*
- Absence of spiral cords surrounding the umbilicus ..... 3
- 3 Axial ribs with constant height through their length; umbilicus narrow ..... *Brookula conica*
- Axial ribs with greater height near to the suture, giving rise to a shoulder below each suture; umbilicus very deep and wide, allowing observation of base of all teleoconch whorls ..... *Brookula megaumbilicata*
- 4 Spiral cords do not cross axial ribs; spiral cords thicker on base ..... *Brookula olearia*
- Spiral cords cross axial ribs; spiral cords of equal thickness over entire surface of shell ..... 5
- 5 Whorl profile flattened next to the sutures ..... *Brookula spinulata*
- Whorl profile uniformly convex ..... *Brookula pfefferi*

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